

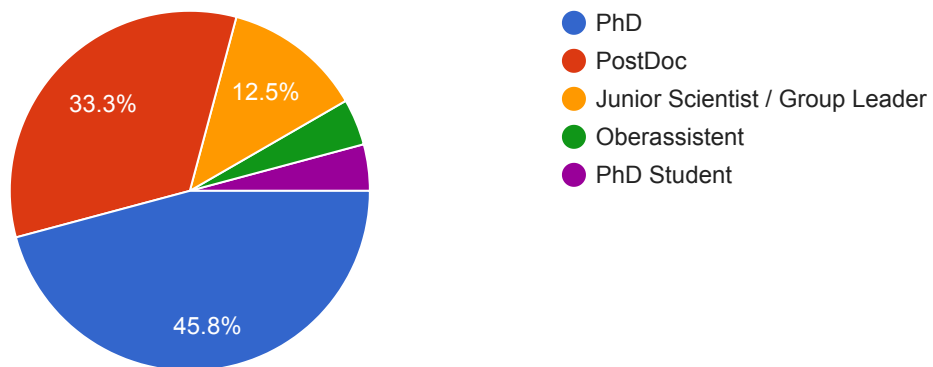
# CHIPP Roadmap Workshop - Pillar 1 questionnaire

24 responses

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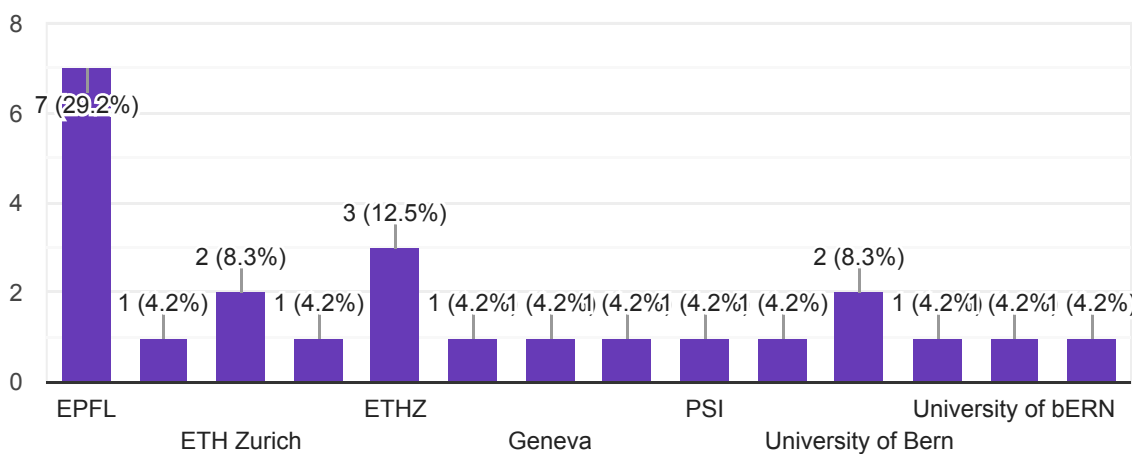
## What is your current status

24 responses



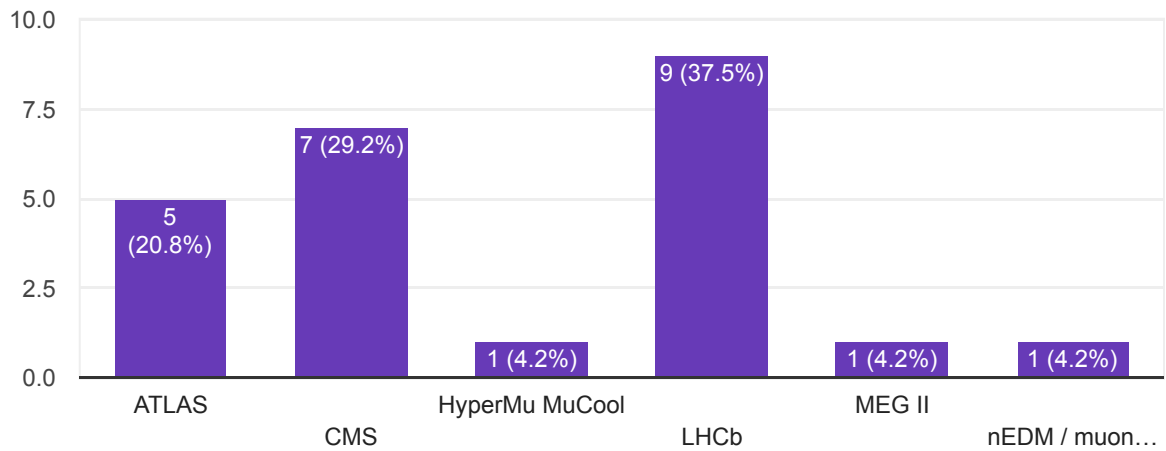
## Which Institute/University are you currently at?

24 responses



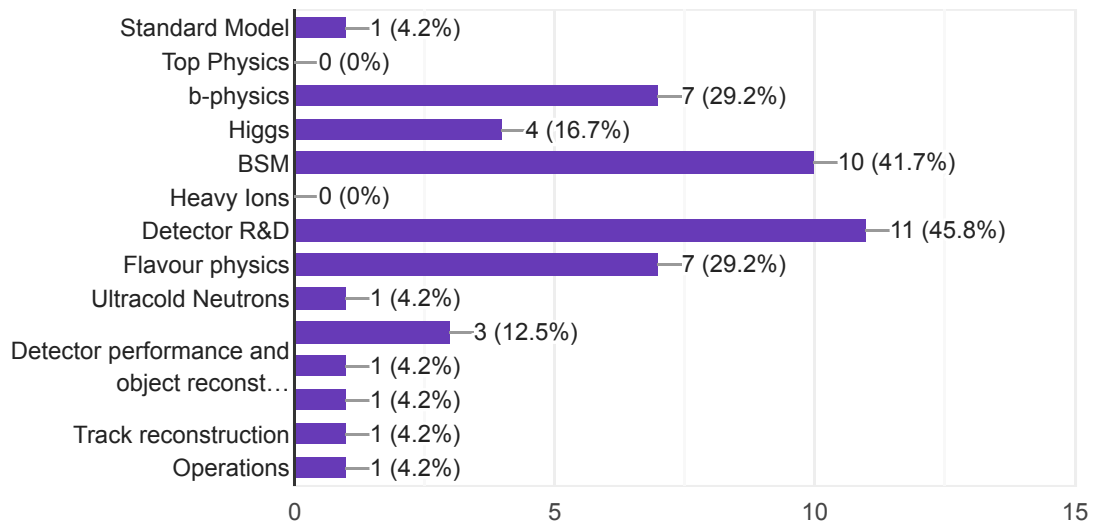
## Which experiment(s) are you currently working on?

24 responses



## In which subfield(s) are you currently working on?

24 responses

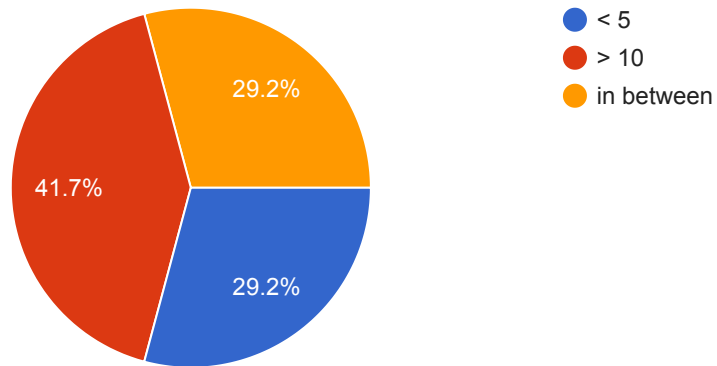


Collaboration



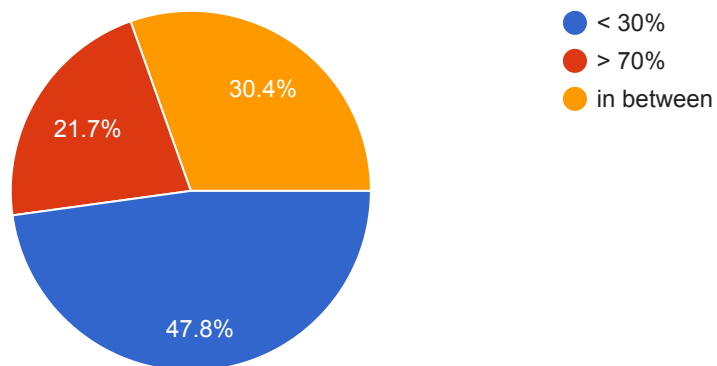
How many collaborators do you have per project on average?

24 responses



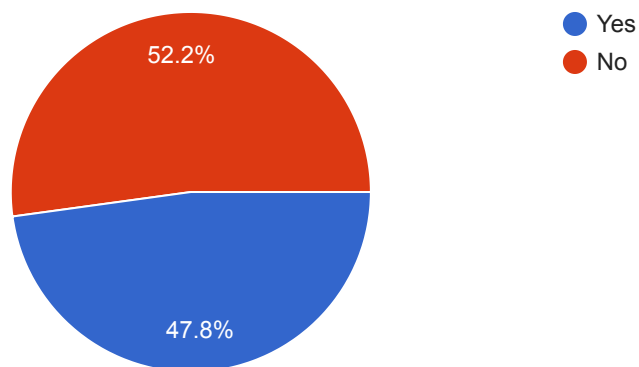
How many of your collaborators are based in Switzerland on average?

23 responses



Do you think Switzerland should join more international collaborations?

23 responses



If yes, which one?

4 responses

Einstein telescope; next-generation colliders if/when decided

NA62 / KLEVER

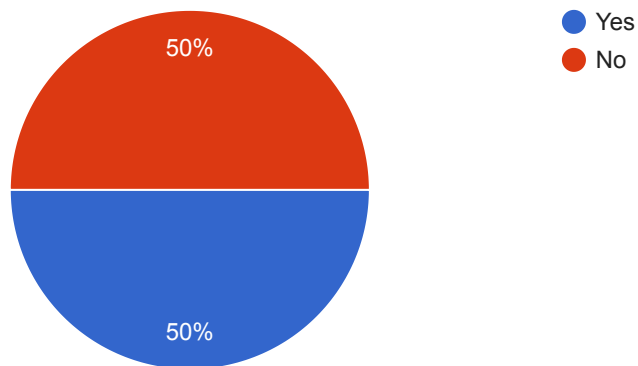
Pacific Ocean Neutrino Experiment, India-based Neutrino Observatory, Brazilian Synchrotron Light Laboratory,

EU

### Collaboration and Interaction within Switzerland

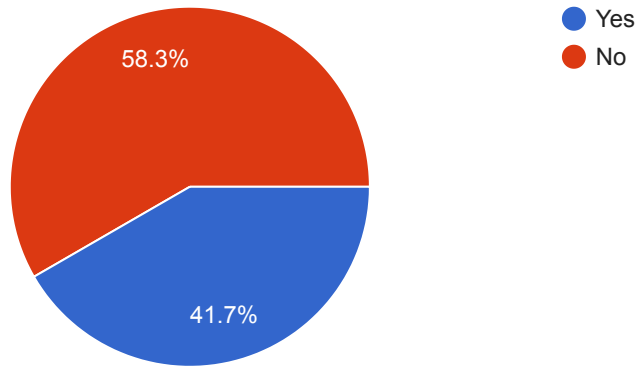
Are you collaborating with people from other Pillar 1 (high-energy and/or high-intensity research) institutes in Switzerland?

24 responses



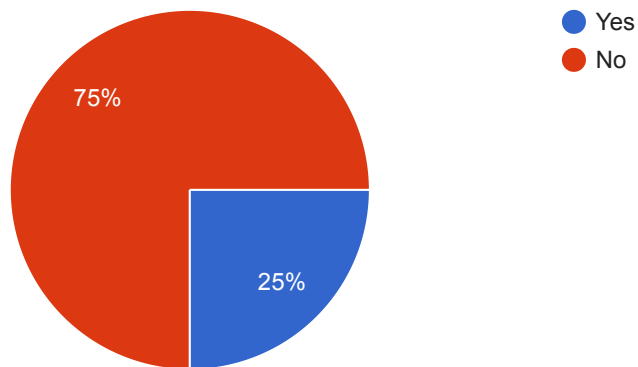
Are there enough opportunities to meet people from other Swiss Pillar 1 institutes/groups?

24 responses



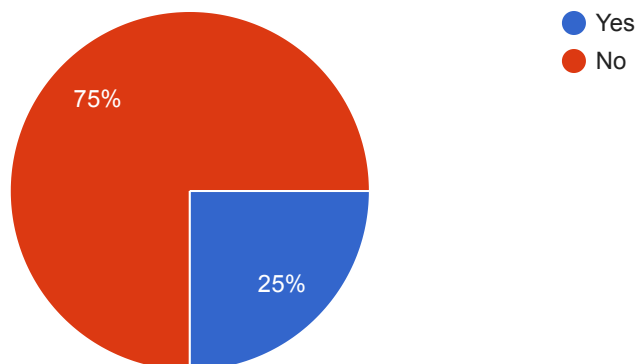
I know what is going on in other Swiss Pillar 1 institutes/groups

24 responses



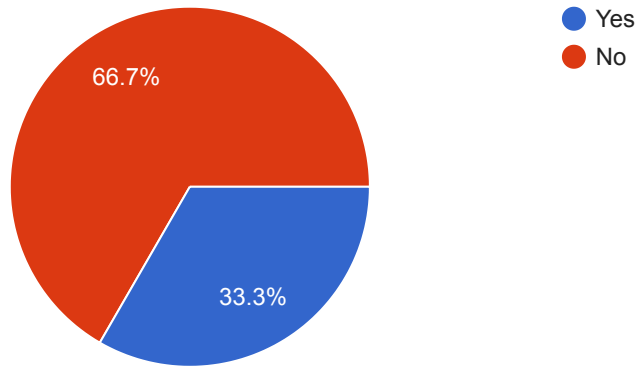
Are there enough opportunities to meet Accelerator Physicists from Swiss institutes/groups?

24 responses



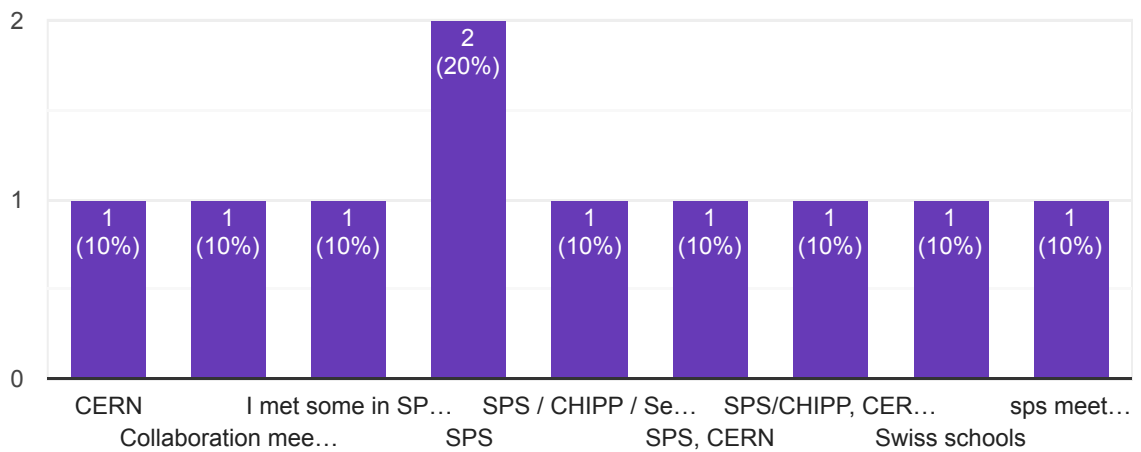
## Are there enough opportunities to meet Early Career Particle Physicists from other Swiss institutes?

24 responses



## If you answered "yes": Where do you usually meet them? (e.g Swiss summer/winter schools, SPS, etc)

10 responses

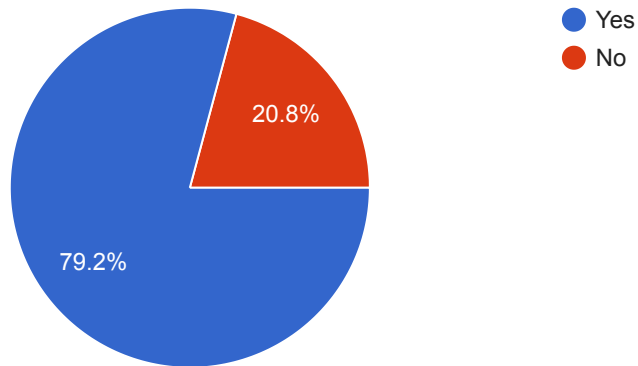


Computing



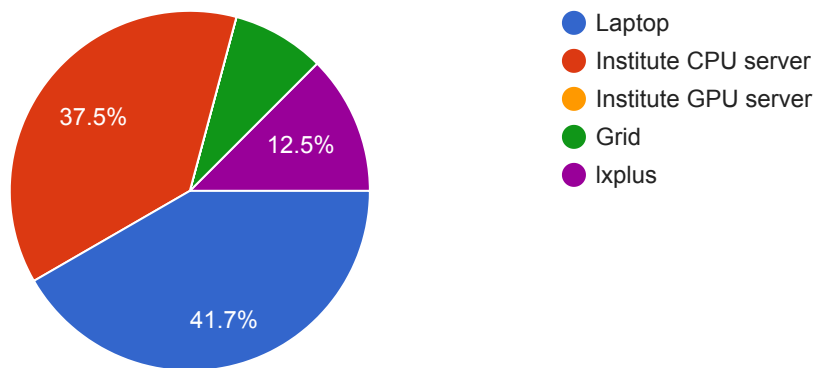
Do you have enough computing resources available for your work?

24 responses



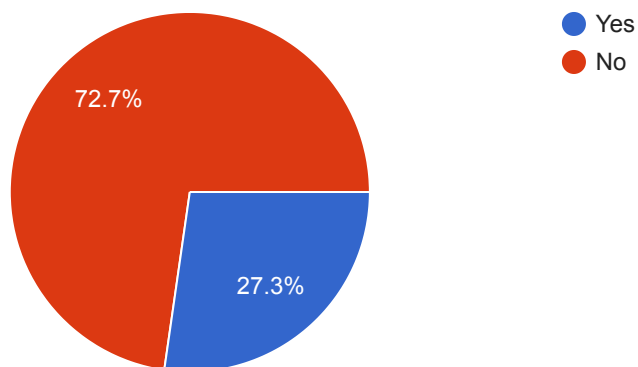
Which computing resource do you use the most?

24 responses



Do you have access to Swiss National Supercomputing Center (CSCS)?

22 responses



If you have got any awards or third-party funding in the last four years, please name it.

9 responses

Multiple, depending on the level of detail you want and when exactly four years begins.

MARIE SKŁODOWSKA-CURIE Fellowship - COFUNDING OF THE CERN FELLOWSHIP PROGRAMME 2014 (COFUND-FP-CERN-2014)

PhD thesis national prize, MSCA fellowship

R'Equip / SNF project grant

ERC consolidator, SNF

poster prize at Pisa Meeting on Advanced Detectors 2018

SNSF Spark

Not while employed in Switzerland

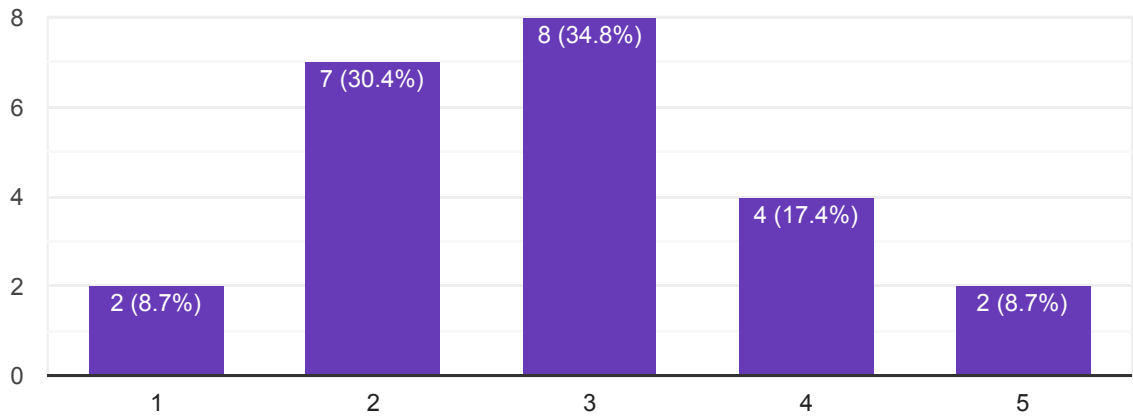
Ambizione





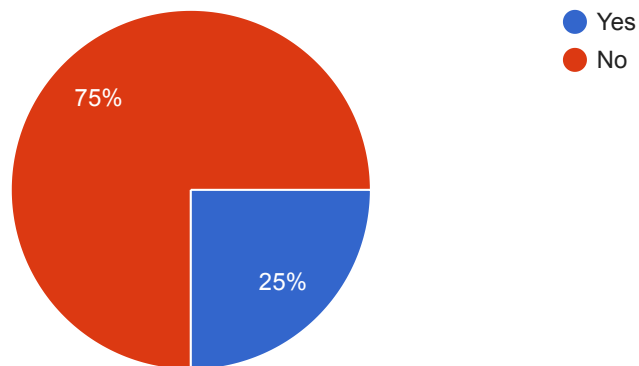
## Quantify the synergies between your research with other disciplines

23 responses



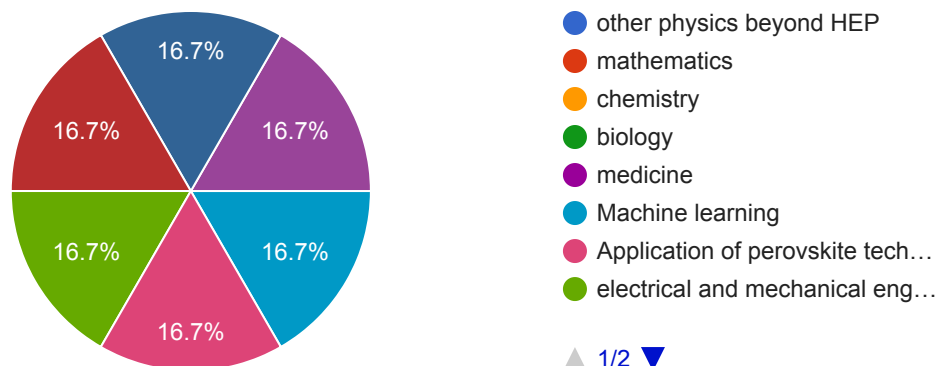
## Are you involved in any interdisciplinary project?

24 responses



## If yes, which one?

6 responses

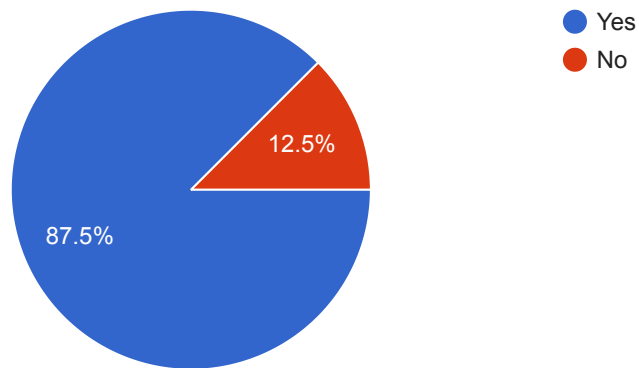


▲ 1/2 ▼



Is your research benefiting from recent advancements in other fields?

24 responses



Is there some recent advancement in another field that you think we are not benefitting enough from?

7 responses

Machine learning / neural networks

Modern silicon chip technologies and post processing developments

Machine learning and deep learning

optical magnetometry

Artificial Intelligence

Computing, Machine Learning

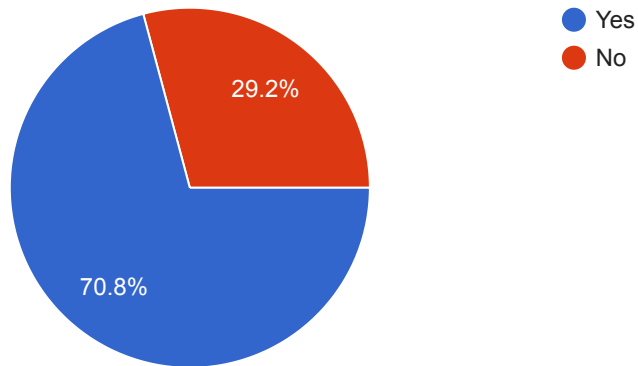
GPU's

Outreach



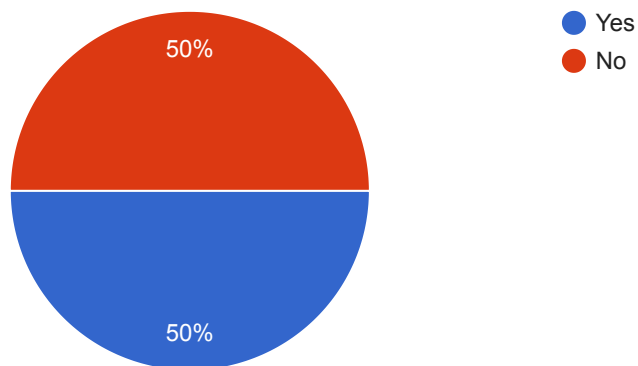
Did you engage in an outreach event in the last four years?

24 responses



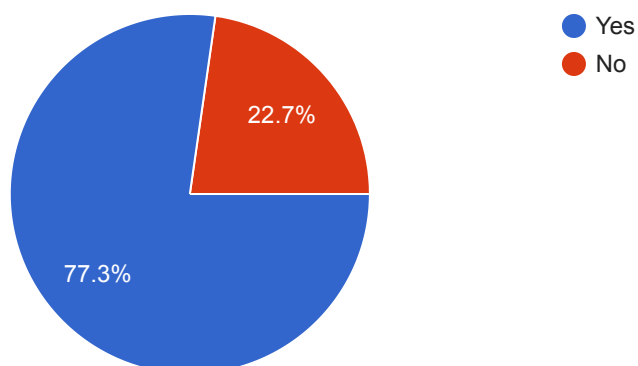
If yes, was it organised by your home institution in Switzerland?

18 responses



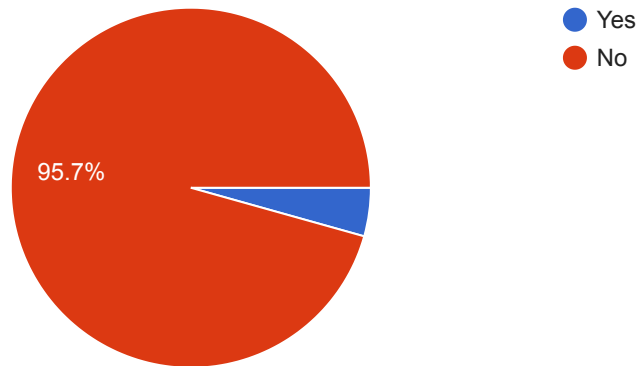
Do you think more organised outreach is needed?

22 responses



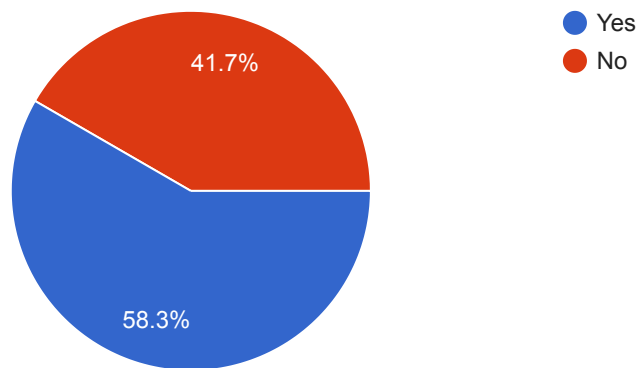
Do you have links with museums, scientific collections, or science NGO-s?

23 responses



Do you perceive your research is positively impacting society?

24 responses

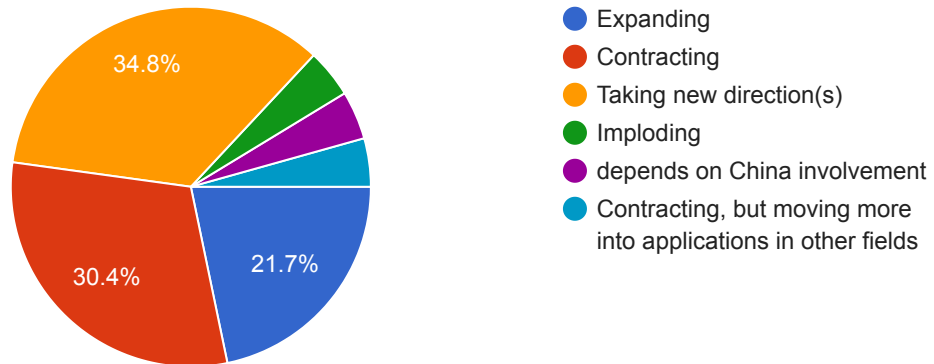


Future of high-energy and low-energy/precision frontier



How do you see particle physics evolving globally in the next few years and more long term (expansion vs. contraction, possible new directions)?

23 responses



If you answered "taking new directions" in the previous question. Which direction(s)?

7 responses

LHC is likely going to ramp down, and until we know what the world is going to do next it's hard to say if this will be directed towards the next collider or something else. Gravitational waves are also likely going to keep rising as sensitivity grows with new experiments.

Towards medium sized experiments, Physics Beyond Collider style. Depending on the outcome of the LHC, there will be either a compelling argument to step to the next level (FCC-ee and -hh) but if not, there is much more power in diversity (more, smaller experiments) than in pursuing big ones.

smaller scale experiments in different places

High intensity and precision even at high energies

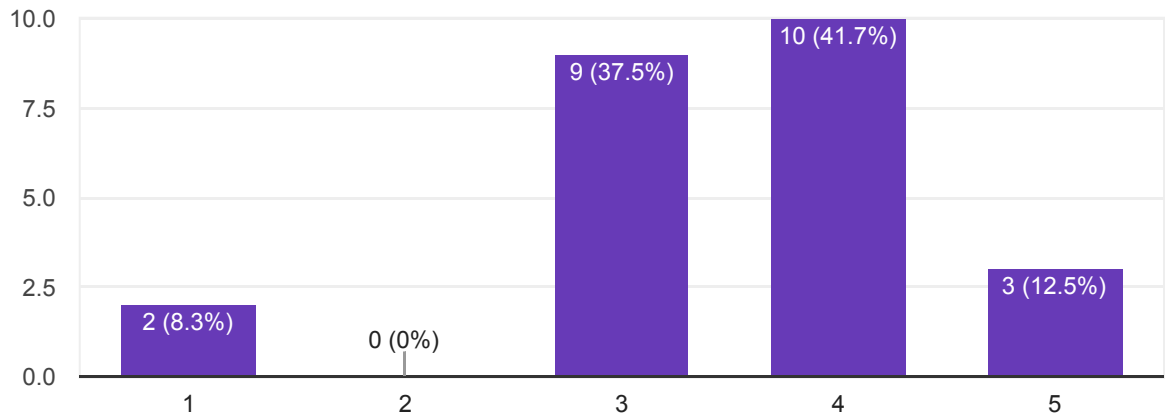
Several "minor" experiments at low energy including high-precision laser spectroscopy

Become more interdisciplinary and involve novel detection methodology



Thank you for filling this survey! Last but not least: Do you think the next decades will be great for particle physics in Switzerland?

24 responses



If you answered "1" or "2": Please tell us why!

3 responses

Bad career opportunities for young scientists, already now. Guess how it will be when there is not even a running machine! And we will have this situation for many many years. Not sure if that still can be solved or is the unavoidable consequence of stacked up wrong decisions made in the past. Smaller experiments, low energy etc can maybe survive, large scale HEP will probably die within next 15-20 years (and maybe revived again in 50 years who knows)

it's 3 and not >3 because of the uncertain success (in my opinion) of the big LHC-like projects

With the current situation, the field has no perspective beyond HL-LHC and the decision process about what comes next seems to be stuck.



## Additional remarks?

3 responses

I hope that we will have more opportunities to contribute to and read the document before the discussion occurs

I am very hopeful for the next decades, I am certain that interesting things will turn up. As a long-term strategy, I think that it is good to diversify the program to include large, but also smaller experiments, like those extensively detailed in the Physics Beyond Colliders program at CERN. The SPS has been driving medium sized experiments for >40 years now, and it seems likely it will continue long after the LHC.

Be aware that a lot of young talented reearchers are driven away from the field because of the lack of perspective. The work environment in the large collaborations also does not help

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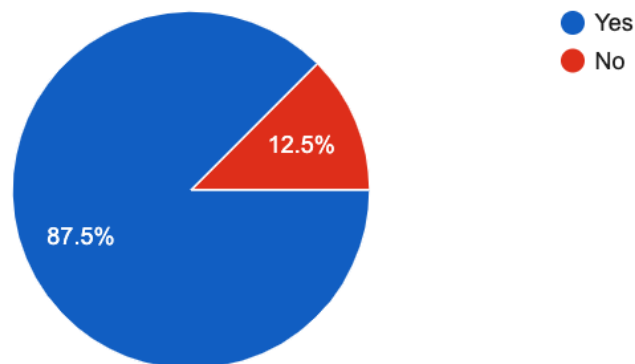


What do you consider a major breakthrough in your experiment or subfield inside Switzerland in the last 4 years?

- Nothing obvious comes to mind, lots of the ATLAS+CMS work right now is more solid but incremental work rather than "breakthroughs". That's not to say it's bad work, it's excellent and Switzerland is contributing a lot, but I think the larger "breakthroughs" are other fields.
- (Very) high precision measurements + discoveries of SM processes
- Study of flavor anomalies
- Hbb observation (for my sub-group I am working with)
- new limit on nEDM/ new limit on gluonic axion coupling
- Helium radius measurement, n-EDM limit
- ATLAS observes W-boson pair production from light colliding with light, Major improvements in detector technologies for higher luminosities
- Lhc run 2 data taking
- Several contributions to analyses in LHCb and the role in building the SciFi detector
- Monolithic silicon pixel sensors

Do you think Switzerland is at the forefront of your experiment or subfield? 

24 responses



What do you think will be the main trends in your subfield in this decade (name at least three keywords)?

- electronics, GPUs, data
- precision precision precision
- machine learning, precision measurements, searches for non-conventional new physics
- Getting the experiments running, small auxiliary detectors, exotic searches with experiments dedicated for another purpose.
- lepton-flavor violation, lepton-flavor universality, hadron spectroscopy
- Bad job opportunities for young scientists, people leaving, HEP dying
- Flavour physics, machine learning, medium size experiments
- Run3



- lepton flavor violation, precision measurements
- BSM searches (dark matter), precision measurements, change in usage of computing power (trend towards ML)
- precision measurements of SM processes, better understanding of backgrounds...
- anomalies, asymmetry, radiation hardness
- monolithic, time resolution, radiation hardness
- increased radiation hard optical detectors, more computational power
- ML, BSM, new collider
- ML, GPU data processing, HPC
- GPU / Quantum Computing, Spectroscopy, Dark Matter / Exotics, B anomalies
- Flavor anomalies, search for very rare/forbidden decays
- Complex ASICs, Machine Learning, advanced triggering

Name a single important question you think can be solved in your field in the near future.

- Does SUSY exist?
- Neutrino hierarchy
- I struggle with this question, as it is hard to define what you mean by "solved". I think that the Higgs couplings outside of di-Higgs will be characterized to a precision that either discovers or rules out many BSM models, but ultimately there is not a clear lower bound and new physics may just interact weakly, so it won't provide a deterministic answer unless we find new physics
- new upper limits for cLFV decays (meg,  $\mu 3e$ )
- Do leptons of different generations behave differently (depends what "near" means)
- figure out what happens if you spend billions on equipment and at the same time don't give a \* about the conditions (especially young) researchers have to work in.
- Is lepton flavour universality violated in B-decays?
- Does "common" BSM physics (e.g. SUSY) exist at TeV scale?
- does Nature agree with lepton flavour universality?
- Does SUPERSYMMETRY exist?
- Flavour anomalies
- measure higgs properties precisely
- B anomalies
- Nature of the flavor anomalies
- b-anomalies

Name a single important question you WANT to be solved in your field.

- Does SUSY exist?
- CP violation from QCD vacuum term
- At what scale does the Standard Model break down (or is it just the Planck scale). I want this to be solved, but once again we likely can only answer this definitively if we actually find something new.
- Measuring  $BR(\mu \rightarrow e + \gamma)$  :
- What is dark matter ? (but it's probably not only a problem of my field!)
- Recognition of personal contributions in large collaborations
- Can we access the dark sector by means of high-energy collisions?

- lepton structure of SM
- What extends (?) the SM explaining open questions such as DM, the hierarchy problem, ...
- dark matter
- What is dark matter?
- do we have more fundamental particles out there?
- Will there be successors of HL-LHC, and if yes, which one?
- Planck particle ...?
- Baryon asymmetry
- find susy
- B anomalies
- Origin of the flavor
- Hint of BSM physics at high energy

If you were to bring new research directions that do not yet exist in Switzerland in your field, what would that be?

- Sensors
- molecular EDM searches using Proactinium at CERN
- More emphasis on computing in high energy physics, and I don't mean just machine learning (but of course that's important too)
- It's not about research directions
- Kaon physics
- R&D on advanced post-processing technologies
- Development of devoted machine learning algorithms to systematically analyse the data in the search for un-known patterns

Describe here your doubts or the greatest risks you see in the future of your field

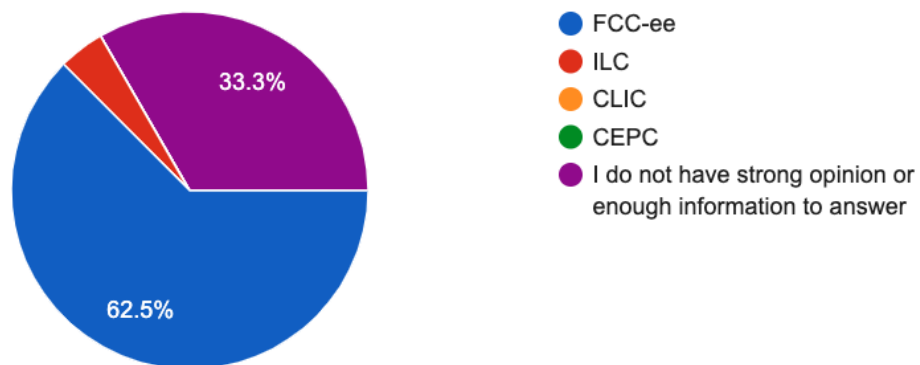
- Losing support from the general public based on oversimplified or false knowledge
- High risk, no fun - putting all money on one horse (LHC upgrade) no signal in return
- Becoming complacent and no longer daring to try challenging new techniques as the complexity continues to grow; similarly, being bound too much to a single mentality without considering alternative directions (particle physics and various other fields are starting to ask very similar questions)
- Funding in times of Corona; delays and conflicts with experiments in the same area that are not as much delayed.
- It's difficult to defend investments in costly machines with so limited theoretical insights (lack of a clear direction)
- Bad career opportunities for young people, only temporary employment, no recognition of personal contributions, and soon not even a running machine
- The FCC not being funded. It is an enormous gamble - and one that could wipe out CERN as the driving force that it is now.
- Academic jobs
- People get trained very focused on recent methods and theories, while we should make sure to keep the minds very open, creative and flexible!
- Losing expertise / interest
- Funding will be reduced if no signs of new physics are found at the HL-LHC

- Many talented young scientists want to avoid the large collaborations that are needed in HEP.
- Not coming up with novel ways of searching for BSM
- ecology
- no new collider at cern, larger chinese involvment in HEP
- Civilizational collapse due to environmental crises
- No big discovery, too expensive big projects, decreasing funding
- Lack of clear experimental paths to new physics, foreseeable lack of funding, overpopulation of the field, reduction of scientific creativity linked to the participation in very big experiments
- Can next-gen accelerator get the needed funds? Can we keep the expertise?

Which one of the proposed big future collider projects do you think is a priority?



24 responses



Why this collider and not another?

- High precision measurement of Higgs might indicate deviation and mass scale for new physics
- The tunnel is a long-term investment that will allow for further improvements in the future, and paired with FCC-hh can provide very high precision (indirect constraints on new physics) and discovery potential (direct searches)
- Upgradeable to hh machine, use ILC as complementary project.
- European, interesting energy range, good first step for FCC-hh
- can have FCC-hh in the same tunnel later
- The ILC has been in limbo for 10 years, and there is no sign of it moving anytime soon. CLIC is a beautiful machine, but there is no compelling reason to do it at CERN, it would just be a completely separate part that has little to no synergy with the remaining accelerator complex. I don't think the technological competence for CEPC exists - it can be done, but it will take twice the time and money that they claim it will. The FCC-ee is supported by a strong team, it is technologically feasible (on the timescale proposed), and offers a long-term future for CERN. If the LHC does not turn

up even hints new physics, since previous large steps were usually heralded by flavour violations and "anomalies", it is likely not possible to access new physics with an e+e- machine. In this case, a next generation hh machine should be the goal, with the FCC-ee forming a very convenient (and worthwhile) intermediate stop. .

- As far as I know, there are many advantages of circular colliders than the linear one for research at CERN.
- CLIC is also nice but you won't let me choose two. Besides, FCC looks more long-term. However, it severely decreases the budget available for other research lines (smaller experiments, dark matter etc) and for this reason it should not be chosen with the eyes blind...
- It can built from resources (manpower, infrastructure) already available at CERN.
- Largest potential (including upgradeability) and best cost/benefit ratio
- FCC is the only sensible option that ensures a future of collaborative HEP beyond 2100. Linear colliders are not useful since they can host only one experiment. FCC could host up to ten.
- Large LHC-like experiment (as all of the above are, despite the different designs and locations), whilst being the natural continuation of LHC, may lose their appeal to the Physics community and funding entities. Social and career dynamics at the LHC's experiments are less than ideal, especially for the younger crowd, and the return/cost of these experiments is not great. We need a breakthrough, a new paradigm. Clearly it's way easier to predicate this than to implement.
- Staged approach (with FCC-hh), CERN with a strong community, rather universal (with B physics programme)
- European collider + easier continuation towards FCC-hh

## How important do you think are issues of sustainability for particle physics?



23 responses

